Fig.1

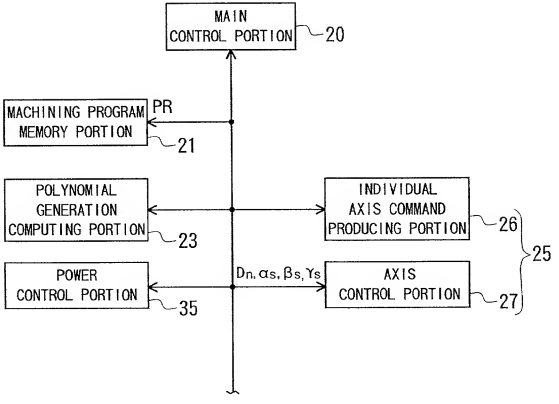

MAIN
CONTROL PORTION
20
MACHINING PROGRAM
MEMORY PORTION
PR
21
POLYNOMIAL
GENERATION
COMPUTING PORTION
23
INDIVIDUAL
AXIS COMMAND
PRODUCING PORTION
26
25
POWER
CONTROL PORTION
35
Dn, αs, βs, γs
AXIS
CONTROL PORTION
27

Fig.2

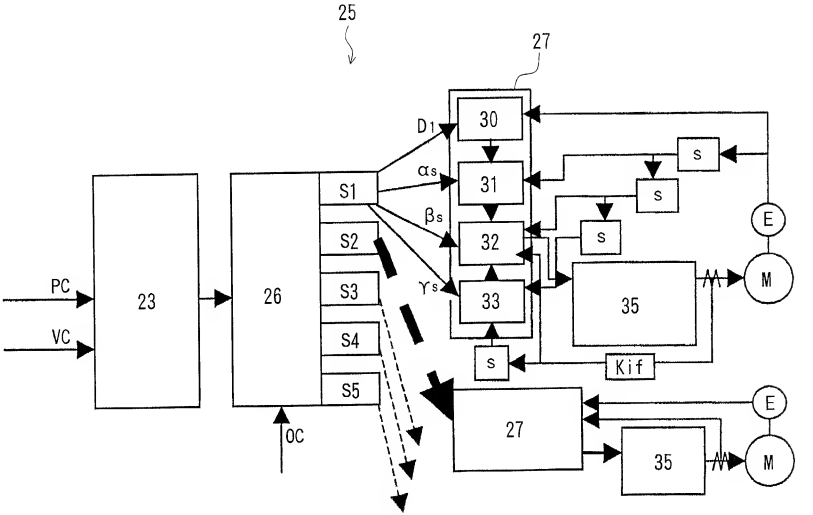
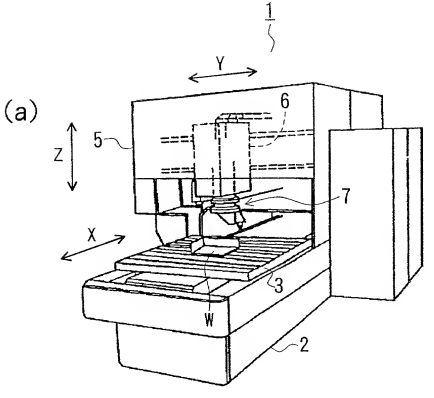

25
27
30
31
32
33
D1
αs
βs
γs
S1
S2
S3
S4
S5
PC
VC
23
26
OC
s
E
M
35
Kif
27

Fig.3



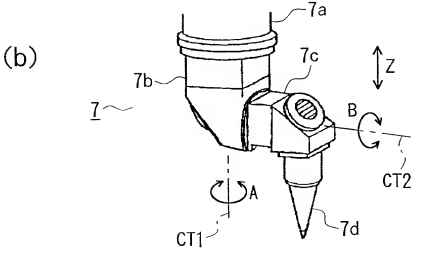


Fig.4

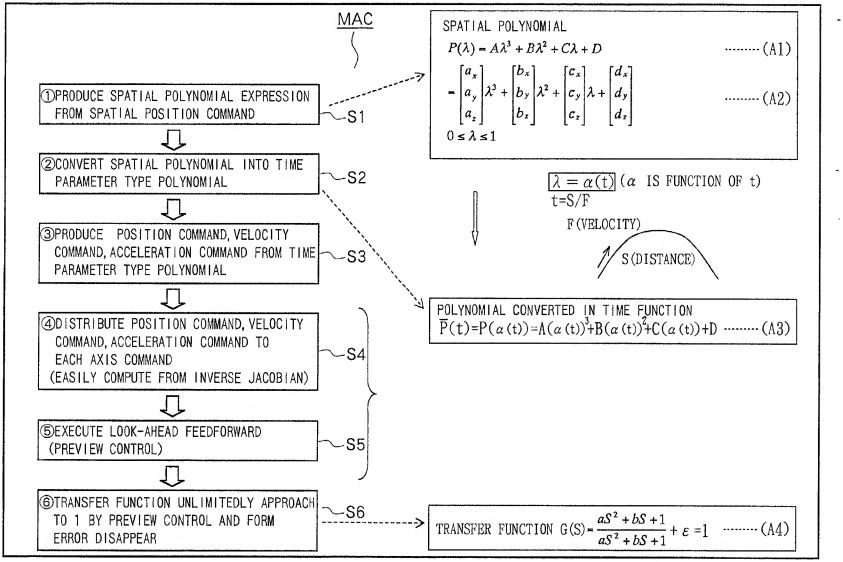

MAC
①PRODUCE SPATIAL POLYNOMIAL EXPRESSION FROM SPATIAL POSITION COMMAND
S1
②CONVERT SPATIAL POLYNOMIAL INTO TIME PARAMETER TYPE POLYNOMIAL
S2
③PRODUCE POSITION COMMAND, VELOCITY COMMAND, ACCELERATION COMMAND FROM TIME PARAMETER TYPE POLYNOMIAL
S3
④DISTRIBUTE POSITION COMMAND, VELOCITY COMMAND, ACCELERATION COMMAND TO EACH AXIS COMMAND (EASILY COMPUTE FROM INVERSE JACOBIAN)
S4
⑤EXECUTE LOOK-AHEAD FEEDFORWARD (PREVIEW CONTROL)
S5
⑥TRANSFER FUNCTION UNLIMITEDLY APPROACH TO 1 BY PREVIEW CONTROL AND FORM ERROR DISAPPEAR
S6
SPATIAL POLYNOMIAL
$P(\lambda) = A\lambda^3 + B\lambda^2 + C\lambda + D$ ..... (A1)
$= \begin{bmatrix} a_x \\ a_y \\ a_z \end{bmatrix}\lambda^3 + \begin{bmatrix} b_x \\ b_y \\ b_z \end{bmatrix}\lambda^2 + \begin{bmatrix} c_x \\ c_y \\ c_z \end{bmatrix}\lambda + \begin{bmatrix} d_x \\ d_y \\ d_z \end{bmatrix}$ ..... (A2)
$0 \leq \lambda \leq 1$
$\lambda = \alpha(t)$ (α IS FUNCTION OF t)
t=S/F
F(VELOCITY)
S(DISTANCE)
POLYNOMIAL CONVERTED IN TIME FUNCTION
$P(t)=P(\alpha(t))=A(\alpha(t))^3+B(\alpha(t))^2+C(\alpha(t))+D$ ..... (A3)
TRANSFER FUNCTION $G(S)=\frac{aS^2+bS+1}{aS^2+bS+1}+\varepsilon=1$ ..... (A4)

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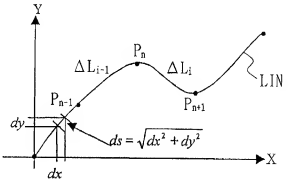
Fig.5



IF LEFT DRAWING IS CURVED LINE DEFINED BY FOLLOWING POLYNOMIAL,

$$y = f(\lambda) = A\lambda^3 + B\lambda^2 + C\lambda + D \quad \cdots\cdots (B1)$$

$$x = g(\lambda)$$

$$\text{IF } 0 \leqq \lambda \leqq 1 \quad \cdots\cdots (B2)$$

IF WHOLE LENGTH OF CURVED LINE DEFINED IS L, FOLLOWING EXPRESSION CAN BE COMPUTED

$$L = \int_0^L ds = \int_0^L \sqrt{dx^2 + dy^2} = \int_0^1 \sqrt{\left(\frac{dx}{d\lambda}\right)^2 + \left(\frac{dy}{d\lambda}\right)^2} \cdot d\lambda \quad \cdots\cdots (B3)$$

FURTHERMORE, FOLLOWING LINE ELEMENT IS DEFINED BY CUTTING PARAMETER λ WITH SEQUENCE $0 = \lambda_0 < \lambda_1, \lambda_2, \cdots, \lambda_i, \cdots < \lambda_n = 1$

$$\Delta L_i = \int_0^{\lambda_i} \sqrt{\left(\frac{dx}{d\lambda}\right)^2 + \left(\frac{dy}{d\lambda}\right)^2} \cdot d\lambda \quad \cdots\cdots (B4)$$

GIVE VELOCITY PROFILE OF VELOCITY FUNCTION F(t) HAVING TIME PARAMETER t ON THIS CORVED LINE AND OBTAIN FOLLOWING EXPRESSION

$$\Delta L_i = \int_0^{t_i} F(t) \cdot dt \quad \cdots\cdots (B5)$$

λ AND t CAN BE RELATED WITH EACH OTHER BY MAKING LENGTH OF THIS LINE SEGMENT EQUAL TO LENGTH OF LINE SEGMENT(1)

$$\Delta L_i = \int_0^{\lambda_i} \sqrt{\left(\frac{dx}{d\lambda}\right)^2 + \left(\frac{dy}{d\lambda}\right)^2} \cdot d\lambda = \int_0^{t_i} F(t) \cdot dt$$

BY SOLVING THIS, FOLLOWING IS COMPUTED

$$\lambda = \alpha(t) \quad \cdots\cdots (B6)$$

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Fig.6

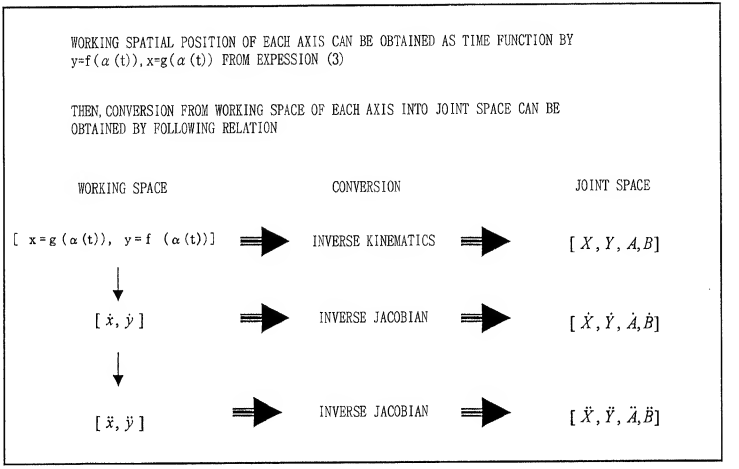
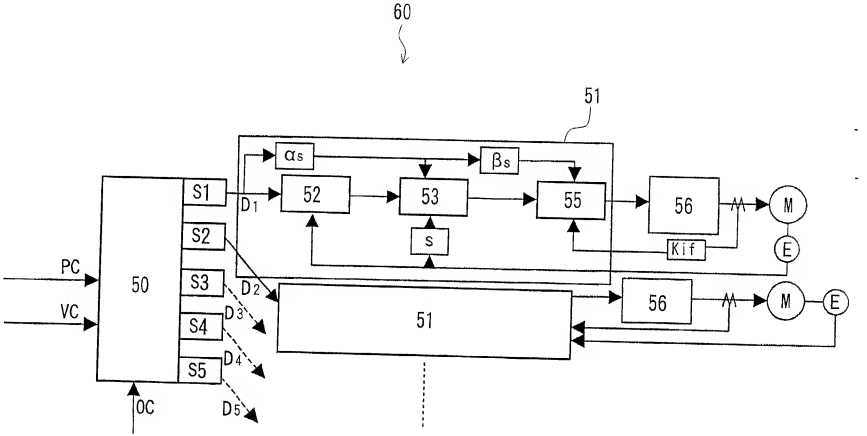


Fig.7


60
51
αs
βs
S1
D1
52
53
55
56
M
S2
s
E
Kif
PC
50
S3
D2
56
M
E
VC
S4
D3
51
S5
D4
0C
D5